

CHAPTER 3.1
LANDFILL COVERS AND LINERS

<u>Paragraph</u>		<u>Page</u>
3.1-1	GENERAL	3.1-1
	a. Purpose and Function	3.1-1
	b. Regulatory Criteria	3.1-1
3.1-2	RCRA HAZARDOUS WASTE LANDFILL COVERS	3.1-1
3.1-3	RCRA HAZARDOUS WASTE LANDFILL LINERS	3.1-1
3.1-4	GENERAL INSPECTION ITEMS FOR LANDFILLS	3.1-2
	a. Third Party Quality Assurance Inspector	3.1-2
	b. Reports	3.1-2
	c. Quality Assurance Laboratory	3.1-3
	d. Quality Assurance Sample Collection	3.1-4
	e. Borrow Source Chemical Contamination Tests	3.1-4
	f. Interface Friction Testing	3.1-4
	g. Geosynthetic Warranties	3.1-5
	h. Anchor Trenches	3.1-5
	i. Access Ramps	3.1-5

CHAPTER 3.1 LANDFILL COVERS AND LINERS

3.1-1. GENERAL

a. Purpose and Function. This section describes the typical configurations used for hazardous waste landfill covers and liners. Subsequent sections describe the QA requirements during construction of the various components of covers and liners. The primary purpose of a landfill is to isolate waste materials from the environment by minimizing the infiltration of surface water, collecting leachate generated by the waste materials, preventing human and animal contact with the waste materials, and controlling landfill gases.

b. Regulatory Criteria. The components of a landfill cover and liner are dependent on functional, environmental, and regulatory factors. The Resource Conservation and Recovery Act (RCRA) provides guidance on cover and liner configurations for both municipal solid waste and hazardous waste landfills. The federal guidelines for municipal solid waste landfills are found in 40 CFR Part 258. The federal guidelines for hazardous waste landfills are found in 40 CFR Part 264. State and local Governmental agencies also have criteria for landfill systems and in some instances, these criteria are more stringent than federal guidelines.

3.1-2. RCRA HAZARDOUS WASTE LANDFILL COVERS. The components of a typical hazardous waste landfill cover are shown below. These components vary from site to site depending on regulatory criteria and availability of soils with the appropriate physical characteristics. From top to bottom, the components of a typical hazardous waste landfill cover are described in Table 3.1.

TABLE 3.1

COMPONENT	MATERIAL TYPICALLY USED
Top Soil	150 mm (6 inches) of top soil
Select Fill	450 mm (18 inches) or more of soil
Filter Layer	Geotextile
Drainage Layer	Geonet or 300 mm (12 inches) of sand or gravel
Barrier Layer	
-Geomembrane	40-60 mil polyethylene or PVC
-Clay	600 mm (24 inch) layer or geosynthetic clay liner
Gas Venting Layer	300 mm (12 inches) of sand/gravel
Foundation Layer	300 mm (12 inches) or more of soil to provide slopes for drainage
Waste Material	

3.1-3. RCRA HAZARDOUS WASTE LANDFILL LINERS. The components of a typical hazardous waste landfill liner are shown below. Again, these components vary from site to site depending on the regulatory

criteria and the availability of soils with appropriate physical characteristics. From top to bottom, the components of a typical hazardous waste landfill liner are described in Table 3.2.

TABLE 3.2

COMPONENT	MATERIAL TYPICALLY USED
Filter Layer	Sand, gravel or geotextile
Leachate Collection Layer	300 mm (12 inches) of sand or gravel
Primary Liner	60-80 mil high density polyethylene (HDPE)
Leak Detection Layer	Geonet
Secondary Liner	
-Geomembrane	60-80 mil HDPE
-Clay	900 mm (36 inch) layer, Hyd. Cond. $\leq 1 \times 10^{-7}$ cm/sec
Subgrade	Existing or imported soil

3.1-4. GENERAL INSPECTION ITEMS FOR LANDFILLS. The following are general inspection items which are not unique to any single component of a landfill cover or liner.

a. Third Party Quality Assurance Inspector. A third party QA Inspector is often hired to inspect the installation of geomembranes and other geosynthetics. If this is the case, many of the inspection responsibilities listed in the following chapters will be performed by the third party QA Inspector.

(1) Verify that the third party QA Inspector has the appropriate qualifications as described in the plans and specifications.

(2) Authority. If an independent third party QA Inspector will be used, make sure the level of authority the QA Inspector has is clearly understood by everyone. They will generally be responsible for monitoring and documenting construction activities. However, they will not have the authority to direct the contractor.

b. Reports. Record keeping and reporting is a key element in the construction of a landfill cover or liner. The following are typical record keeping and reporting requirements during construction.

(1) Daily Reports. The purpose of daily reports is to provide a summary of QA activities performed by the third party QA Inspectors and to highlight matters requiring the COR's action. The following is an outline for a typical daily report:

- project name, location, and date;
- weather conditions, including: temperature (daily high and low); wind direction and speed; last precipitation event; and amount of precipitation;
- construction activities underway, equipment in use, and QC testing performed;
- summary of QA activities;
- items requiring action by the COR; and
- list of any conferences with the contractor or Government personnel.

(2) Final Report. The last phase of landfill construction QA involves preparing a final report by the QA inspection team. The final report will be completed at the end of construction and typically includes the following information:

- brief description of the project, including type of facility, name of site, location, name of owner, design engineer, geomembrane installer, earthwork contractor, etc.;
- detailed description of the lining system, including surface area, cross section, definition of all materials, etc.;
- reference to the construction QA plan;
- copy of geosynthetic material specifications;
- copy of, or reference to, geosynthetic manufacturer's QC documentation;
- general record of activities, such as dates of performance of QA operations, number and names of QA Inspectors, number and names of geosynthetic Installer's personnel, etc.;
- photographic record including photographs of the site at different phases of construction, photographs of construction details, and photographs of QA operations;
- A copy of all forms and logs filled out by QA Inspectors and of all their daily reports;
- copy of all field and laboratory test results;
- discussion of special problems encountered and their solutions;
- copy of the written acceptance of the subgrade by the geomembrane and GCL installers; and
- statement that construction has been done in substantial accordance with the design (including modifications, if any, approved by the design engineer).

c. Quality Assurance Laboratory. Check to see if the specifications or QA plan require the use of an independent QA

Laboratory to test geosynthetics and/or soils.

(1) If an independent QA Laboratory is used, verify the Laboratory's qualifications statement, including resumes of key personnel involved in testing, conform to the requirements outlined in the specifications.

d. Quality Assurance Sample Collection

(1) Review the plans and specifications to determine if QA (conformance) testing is required and on which materials. Samples should be collected at locations approved by the QA Representative. A QA Representative should be present during collection of these samples to ensure they are properly packaged.

(2) If QA testing will be performed, geosynthetic samples are usually collected by cutting a 900 mm (3 foot) long sample for the entire width of the roll being tested. The outside layer of geosynthetic rolls is often removed prior to collecting QA samples. Samples must be properly identified with a unique sample number, project name, sample location and date. For geosynthetics, the manufacturer's name, product identification, lot and roll number, and machine direction should also be identified.

(3) Determine if the specifications contain any special requirements for QA sample packaging.

(a) GCL samples are usually tightly rolled onto a 75 mm (3 inch) diameter core and then covered with 2 layers of plastic sheeting. Tape should be used to hold the plastic sheeting in place.

(b) Geomembranes are generally wrapped on a cylinder and taped in place. Geonet and geotextile samples are generally placed in a box for safe shipment.

(4) Verify test results from the QA laboratory meet the requirements stated in the specifications.

e. Borrow Source Chemical Contamination Tests. All borrow soils are generally tested prior to use to verify they are not contaminated. The plans and specifications should indicate the frequency of testing and what testing should be performed to verify borrow soils are clean. Contact the designer if this information is not provided.

f. Interface Friction Testing. The interface frictional resistance of geosynthetics is often low. Since landfill covers and liners generally have steep slopes, this creates potential stability problems. To ensure a landfill cover or liner will not slip, the contractor is often required to perform direct shear tests on the geosynthetic interfaces.

(1) Verify friction test results indicate adequate interface shear strength exists at the geosynthetic interfaces. Minimum interface shear strength requirements should be outlined in the plans and specifications. Contact the designer if they are not.

(2) Check to see that all interface shear strength tests are performed using the specified normal stresses, strain rates, moisture conditions, and other test requirements outlined in the specifications.

(3) Verify the same geosynthetics and borrow sources used for interface friction testing will be used for full scale construction.

g. Geosynthetics Warranties. Designers or regulators often require warranties for geosynthetics. The length requirements for warranties vary significantly from project to project. Warranties are often required from both the geosynthetics manufacturer and the geosynthetics installer.

(1) Review the plans and specifications to determine which geosynthetics have warranty requirements. Become familiar with these warranty requirements.

(2) Discuss warranty requirements with the designer prior to the start of construction if the requirements are not clear.

(3) Review the warranty submittals to verify if they comply with the warranty requirements.

h. Anchor Trenches. Geosynthetics used to line waste facilities terminate in an anchor trench located around the perimeter of the liner system. Anchor trenches are typically U or V shaped. U shaped trenches are generally a minimum of 450 mm (18 inches) deep and 300 mm (12 inches) wide. Verify the anchor trench is constructed to the correct dimensions.

(1) Check the plans and specifications to determine the termination point of each geosynthetic layer.

(2) Double liner systems will generally have separate anchor trenches for primary and secondary liner systems. Verify the anchor trenches are correctly located.

(3) Ensure that the corners of anchor trenches are slightly rounded to avoid sharp bends in the geosynthetics.

(4) Verify loose soil is removed from the bottom of the anchor trench prior to placement of the geosynthetics.

(5) Require the anchor trench to be dewatered (pumped out) if ponded water is present in the bottom of the trench.

(6) Backfilling of the anchor trench should be accomplished with approved backfill soils placed at the required moisture content and compacted to the required density. Carefully inspect compaction work within the anchor trench because equipment used to compact the soil can easily damage the geosynthetics.

i. Access Ramps. Heavily loaded vehicles must enter landfill liners during construction activities and during placement of solid waste. Access ramps for large landfills will be up to 5.5 m (18 ft) in width and have grades of up to 12 percent. Large landfills will incorporate an access ramp into the layout of the liner. Access to small landfill liners with short side slopes will generally be accomplished by simply placing a thick layer of soil over the liner at the access point.

(1) Strictly enforce any requirements concerning vehicle speeds and number of vehicles on access ramps.

(2) Construction equipment should not be allowed to brake sharply while on the ramp.

EP 415-1-261
15 Jul 97

(3) Regularly inspect the access ramp for cracks and slippage of protective soils layers.

(4) Also inspect the protective soil layers to ensure that thinning of this layer is not occurring due to traffic or erosion. Typically, these protective layers should be a minimum of 900 mm (3 feet) in thickness.